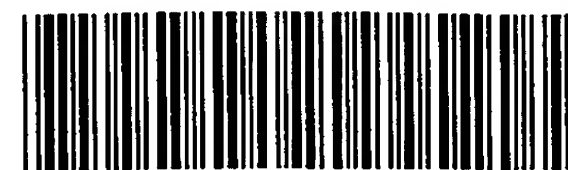


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OIPE

RAW SEQUENCE LISTING

PATENT APPLICATION: US/10/025,145A

DATE: 07/23/2002

TIME: 15:54:32

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Output Set: N:\CRF3\07232002\J025145A.raw

3 <110> APPLICANT: Croteau, Rodney B.
 4 Bohlmann, Joerg
 5 Steele, Christopher L.
 6 Phillips, Michael A.
 8 <120> TITLE OF INVENTION: Monoterpene Synthases from Grand Fir (Abies Grandis)
 10 <130> FILE REFERENCE: WSUR118414
 12 <140> CURRENT APPLICATION NUMBER: 10/025,145A
 C--> 13 <141> CURRENT FILING DATE: 2002-06-28
 15 <150> PRIOR APPLICATION NUMBER: US 09/360,545
 16 <151> PRIOR FILING DATE: 1999-07-26
 18 <150> PRIOR APPLICATION NUMBER: PCT/US98/14528
 19 <151> PRIOR FILING DATE: 1998-07-10
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 22 <151> PRIOR FILING DATE: 1997-07-11
 24 <160> NUMBER OF SEQ ID NOS: 107
 26 <170> SOFTWARE: PatentIn version 3.1
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 29 <211> LENGTH: 2196
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 31 <213> ORGANISM: Abies Grandis
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 34 <221> NAME/KEY: CDS
 35 <222> LOCATION: (69)..(1952)
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 44 1 5 10
 46 ctg cgc aag tcg ttg atc agt tca att cat gaa cat aag cct ccc tat 158
 47 Leu Arg Lys Ser Leu Ile Ser Ser Ile His Glu His Lys Pro Pro Tyr
 48 15 20 25 30
 50 aga aca atc cca aat ctt gga atg cgt agg cga ggg aaa tct gtc acg 206
 51 Arg Thr Ile Pro Asn Leu Gly Met Arg Arg Arg Gly Lys Ser Val Thr
 52 35 40 45
 54 cct tcc atg agc atc agt ttg gcc acc gct gca cct gat gat ggt gta 254
 55 Pro Ser Met Ser Ile Ser Leu Ala Thr Ala Ala Pro Asp Asp Gly Val
 56 50 55 60
 58 caa aga cgc ata ggt gac tac cat tcc aat atc tgg gac gat gat ttc 302
 59 Gln Arg Arg Ile Gly Asp Tyr His Ser Asn Ile Trp Asp Asp Asp Phe
 60 65 70 75
 62 ata cag tct cta tca acg cct tat ggg gaa ccc tct tac cag gaa cgt 350
 63 Ile Gln Ser Leu Ser Thr Pro Tyr Gly Glu Pro Ser Tyr Gln Glu Arg

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RAW SEQUENCE LISTING

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DATE: 07/23/2002

TIME: 15:54:32

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67	Ala Glu Arg Leu Ile	Val Glu Val Lys Lys Ile Phe Asn Ser Met Tyr		
68	95	100	105	110
70	ctg gat gat gga aga tta atg agt tcc ttt aat gat ctc atg caa cgc	446		
71	Leu Asp Asp Gly Arg Leu Met Ser Ser Phe Asn Asp Leu Met Gln Arg			
72		115	120	125
74	ctt tgg ata gtc gat agc gtt gaa cgt ttg ggg ata gct aga cat ttc	494		
75	Leu Trp Ile Val Asp Ser Val Glu Arg Leu Gly Ile Ala Arg His Phe			
76		130	135	140
78	aag aac gag ata aca tca gct ctg gat tat gtt ttc cgt tac tgg gag	542		
79	Lys Asn Glu Ile Thr Ser Ala Leu Asp Tyr Val Phe Arg Tyr Trp Glu			
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82	gaa aac ggc att gga tgt ggg aga gac agt att gtt act gat ctc aac	590		
83	Glu Asn Gly Ile Gly Cys Gly Arg Asp Ser Ile Val Thr Asp Leu Asn			
84		160	165	170
86	tca act gcg ttg ggg ttt cga act ctt cga tta cac ggg tac act gta	638		
87	Ser Thr Ala Leu Gly Phe Arg Thr Leu Arg Leu His Gly Tyr Thr Val			
88	175	180	185	190
90	tct cca gag gtt tta aaa gct ttt caa gat caa aat gga cag ttt gta	686		
91	Ser Pro Glu Val Leu Lys Ala Phe Gln Asp Gln Asn Gly Gln Phe Val			
92		195	200	205
94	tgc tcc ccc ggt cag aca gag ggt gag atc aga agc gtt ctt aac tta	734		
95	Cys Ser Pro Gly Gln Thr Glu Gly Glu Ile Arg Ser Val Leu Asn Leu			
96		210	215	220
98	tat cgg gct tcc ctc att gcc ttc cct ggt gag aaa gtt atg gaa gaa	782		
99	Tyr Arg Ala Ser Leu Ile Ala Phe Pro Gly Glu Lys Val Met Glu Glu			
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102	gct gaa atc ttc tcc aca aga tat ttg aaa gaa gct cta caa aag att	830		
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106	cca gtc tcc gct ctt tca caa gag ata aag ttt gtt atg gaa tat ggc	878		
107	Pro Val Ser Ala Leu Ser Gln Glu Ile Lys Phe Val Met Glu Tyr Gly			
108	255	260	265	270
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111	Trp His Thr Asn Leu Pro Arg Leu Glu Ala Arg Asn Tyr Ile Asp Thr			
112		275	280	285
114	ctt gag aaa gac acc agt gca tgg ctc aat aaa aat gct ggg aag aag	974		
115	Leu Glu Lys Asp Thr Ser Ala Trp Leu Asn Lys Asn Ala Gly Lys Lys			
116		290	295	300
118	ctt tta gaa ctt gca aaa ttg gag ttc aat ata ttt aac tcc tta caa	1022		
119	Leu Leu Glu Leu Ala Lys Leu Glu Phe Asn Ile Phe Asn Ser Leu Gln			
120		305	310	315
122	caa aag gaa tta caa tat ctt ttg aga tgg tgg aaa gag tcg gat ttg	1070		
123	Gln Lys Glu Leu Gln Tyr Leu Leu Arg Trp Trp Lys Glu Ser Asp Leu			
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126	cct aaa ttg aca ttt gct cgg cat cgt cat gtg gaa ttc tac act ttg	1118		
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RAW SEQUENCE LISTING

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Output Set: N:\CRF3\07232002\J025145A.raw

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134	ttc	gcc	aaa	atg	tgt	cat	ctt	gtc	aca	ggt	ttg	gac	gat	att	tac	gac	1214
135	Phe	Ala	Lys	Met	Cys	His	Leu	Val	Thr	Val	Leu	Asp	Asp	Ile	Tyr	Asp	
136					370					375						380	
138	act	ttt	gga	acg	att	gac	gag	ctt	gaa	ctc	ttc	aca	tct	gca	att	aag	1262
139	Thr	Phe	Gly	Thr	Ile	Asp	Glu	Leu	Glu	Leu	Phe	Thr	Ser	Ala	Ile	Lys	
140					385					390						395	
142	aga	tgg	aat	tca	tca	gag	ata	gaa	cac	ctt	cca	gaa	tat	atg	aaa	tgt	1310
143	Arg	Trp	Asn	Ser	Ser	Glu	Ile	Glu	His	Leu	Pro	Glu	Tyr	Met	Lys	Cys	
144		400						405					410				
146	gtg	tac	atg	gtc	gtg	ttt	gaa	act	gta	aat	gaa	ctg	aca	cga	gag	gcg	1358
147	Val	Tyr	Met	Val	Val	Phe	Glu	Thr	Val	Asn	Glu	Leu	Thr	Arg	Glu	Ala	
148	415					420					425					430	
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151	Glu	Lys	Thr	Gln	Gly	Arg	Asn	Thr	Leu	Asn	Tyr	Val	Arg	Lys	Ala	Trp	
152					435					440						445	
154	gag	gct	tat	ttt	gat	tca	tat	atg	gaa	gaa	gca	aaa	tgg	atc	tct	aat	1454
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159	Gly	Tyr	Leu	Pro	Met	Phe	Glu	Glu	Tyr	His	Glu	Asn	Gly	Lys	Val	Ser	
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162	tct	gca	tat	cgc	gta	gca	aca	ttg	caa	ccc	atc	ctc	act	ttg	aat	gca	1550
163	Ser	Ala	Tyr	Arg	Val	Ala	Thr	Leu	Gln	Pro	Ile	Leu	Thr	Leu	Asn	Ala	
164		480						485					490				
166	tgg	ctt	cct	gat	tac	atc	ttg	aag	gga	att	gat	ttt	cca	tcc	agg	ttc	1598
167	Trp	Leu	Pro	Asp	Tyr	Ile	Leu	Lys	Gly	Ile	Asp	Phe	Pro	Ser	Arg	Phe	
168	495					500					505					510	
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176					530					535						540	
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179	Tyr	Met	Lys	Asp	Asn	Pro	Gly	Ser	Thr	Glu	Glu	Asp	Ala	Leu	Asn	His	
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182	atc	aat	gcc	atg	gtc	aat	gac	ata	atc	aaa	gaa	tta	aat	tgg	gaa	ctt	1790
183	Ile	Asn	Ala	Met	Val	Asn	Asp	Ile	Ile	Lys	Glu	Leu	Asn	Trp	Glu	Leu	
184		560						565								570	
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187	Leu	Arg	Ser	Asn	Asp	Asn	Ile	Pro	Met	Leu	Ala	Lys	Lys	His	Ala	Phe	
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191	Asp	Ile	Thr	Arg	Ala	Leu	His	His	Leu	Tyr	Ile	Tyr	Arg	Asp	Gly	Phe	
192					595					600						605	
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200          625
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204 atcgtgtggg tatgattaa aagctagagc ttactaggtt agtaacatgg tgataaaagt      2102
206 tataaaatgt gagttataga gatacccatg ttgaataatg aattacaaaa agagaaattt      2162
208 atgtagaata agattggaag cttttcaatt gttt      2196
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226 Ile Pro Asn Leu Gly Met Arg Arg Arg Gly Lys Ser Val Thr Pro Ser
227          35          40          45
230 Met Ser Ile Ser Leu Ala Thr Ala Ala Pro Asp Asp Gly Val Gln Arg
231          50          55          60
234 Arg Ile Gly Asp Tyr His Ser Asn Ile Trp Asp Asp Asp Phe Ile Gln
235 65          70          75          80
238 Ser Leu Ser Thr Pro Tyr Gly Glu Pro Ser Tyr Gln Glu Arg Ala Glu
239          85          90          95
242 Arg Leu Ile Val Glu Val Lys Lys Ile Phe Asn Ser Met Tyr Leu Asp
243          100         105         110
246 Asp Gly Arg Leu Met Ser Ser Phe Asn Asp Leu Met Gln Arg Leu Trp
247          115         120         125
250 Ile Val Asp Ser Val Glu Arg Leu Gly Ile Ala Arg His Phe Lys Asn
251          130         135         140
254 Glu Ile Thr Ser Ala Leu Asp Tyr Val Phe Arg Tyr Trp Glu Glu Asn
255 145         150         155         160
258 Gly Ile Gly Cys Gly Arg Asp Ser Ile Val Thr Asp Leu Asn Ser Thr
259          165         170         175
262 Ala Leu Gly Phe Arg Thr Leu Arg Leu His Gly Tyr Thr Val Ser Pro
263          180         185         190
266 Glu Val Leu Lys Ala Phe Gln Asp Gln Asn Gly Gln Phe Val Cys Ser
267          195         200         205
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271          210         215         220
274 Ala Ser Leu Ile Ala Phe Pro Gly Glu Lys Val Met Glu Glu Ala Glu
275 225         230         235         240
278 Ile Phe Ser Thr Arg Tyr Leu Lys Glu Ala Leu Gln Lys Ile Pro Val
279          245         250         255
282 Ser Ala Leu Ser Gln Glu Ile Lys Phe Val Met Glu Tyr Gly Trp His
283          260         265         270
286 Thr Asn Leu Pro Arg Leu Glu Ala Arg Asn Tyr Ile Asp Thr Leu Glu

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RAW SEQUENCE LISTING

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295 305          310          315          320
298 Glu Leu Gln Tyr Leu Leu Arg Trp Trp Lys Glu Ser Asp Leu Pro Lys
299          325          330          335
302 Leu Thr Phe Ala Arg His Arg His Val Glu Phe Tyr Thr Leu Ala Ser
303          340          345          350
306 Cys Ile Ala Ile Asp Pro Lys His Ser Ala Phe Arg Leu Gly Phe Ala
307          355          360          365
310 Lys Met Cys His Leu Val Thr Val Leu Asp Asp Ile Tyr Asp Thr Phe
311          370          375          380
314 Gly Thr Ile Asp Glu Leu Glu Leu Phe Thr Ser Ala Ile Lys Arg Trp
315 385          390          395          400
318 Asn Ser Ser Glu Ile Glu His Leu Pro Glu Tyr Met Lys Cys Val Tyr
319          405          410          415
322 Met Val Val Phe Glu Thr Val Asn Glu Leu Thr Arg Glu Ala Glu Lys
323          420          425          430
326 Thr Gln Gly Arg Asn Thr Leu Asn Tyr Val Arg Lys Ala Trp Glu Ala
327          435          440          445
330 Tyr Phe Asp Ser Tyr Met Glu Glu Ala Lys Trp Ile Ser Asn Gly Tyr
331          450          455          460
334 Leu Pro Met Phe Glu Glu Tyr His Glu Asn Gly Lys Val Ser Ser Ala
335 465          470          475          480
338 Tyr Arg Val Ala Thr Leu Gln Pro Ile Leu Thr Leu Asn Ala Trp Leu
339          485          490          495
342 Pro Asp Tyr Ile Leu Lys Gly Ile Asp Phe Pro Ser Arg Phe Asn Asp
343          500          505          510
346 Leu Ala Ser Ser Phe Leu Arg Leu Arg Gly Asp Thr Arg Cys Tyr Lys
347          515          520          525
350 Ala Asp Arg Asp Arg Gly Glu Glu Ala Ser Cys Ile Ser Cys Tyr Met
351          530          535          540
354 Lys Asp Asn Pro Gly Ser Thr Glu Glu Asp Ala Leu Asn His Ile Asn
355 545          550          555          560
358 Ala Met Val Asn Asp Ile Ile Lys Glu Leu Asn Trp Glu Leu Leu Arg
359          565          570          575
362 Ser Asn Asp Asn Ile Pro Met Leu Ala Lys Lys His Ala Phe Asp Ile
363          580          585          590
366 Thr Arg Ala Leu His His Leu Tyr Ile Tyr Arg Asp Gly Phe Ser Val
367          595          600          605
370 Ala Asn Lys Glu Thr Lys Lys Leu Val Met Glu Thr Leu Leu Glu Ser
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380 <212> TYPE: DNA
381 <213> ORGANISM: Abies Grandis

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DATE: 07/23/2002
TIME: 15:54:33

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Output Set: N:\CRF3\07232002\J025145A.raw

Please Note:

Use of n and/or Xaa have been detected in the Sequence Listing. Please review the Sequence Listing to ensure that a corresponding explanation is presented in the <220> to <223> fields of each sequence which presents at least one n or Xaa.

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Seq#:8; N Pos. 6,12
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Seq#:13; N Pos. 89
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Seq#:21; N Pos. 3,12
Seq#:22; N Pos. 6,12,15,18
Seq#:23; N Pos. 7,10,16
Seq#:25; Xaa Pos. 3,4,6,8
Seq#:26; Xaa Pos. 3,4,6
Seq#:27; Xaa Pos. 2,3,4
Seq#:28; Xaa Pos. 6
Seq#:45; Xaa Pos. 3,4
Seq#:46; Xaa Pos. 4
Seq#:50; Xaa Pos. 1
Seq#:51; Xaa Pos. 1
Seq#:52; Xaa Pos. 1
Seq#:53; Xaa Pos. 6
Seq#:56; N Pos. 1,4,7